Creating Decolonial Sustainable Learning Environments for the Fourth Industrial Revolution in the Rural and Urban Higher Education Contexts: A Study of Inclusive Management Strategies

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Abstract

This paper explores some decolonial management strategies in four Higher Education Institutions in South Africa that seem suitable for the creation of Sustainable Learning Environments (SuLE), in anticipation of, and in the context of the Fourth Industrial Revolution (4IR). These strategies are considered to be decolonial in that they are inclusive and valorise other forms of managing beyond those that are conventional and western in orientation. Furthermore, they validate the local experience and the particularity of the individuals and institutions under scrutiny. There are currently demands for high levels of technological acumen within the higher education sector, hence the labour markets. However, there are those workers and students in the Higher Education sector who are at the middle to lower end of the performance levels and who may be rendered superfluous and at risk of failure and dropping out, if they are unable to access these high-level skills and expertise. These tend to be left out as their institutions and societies advance technologically, resulting in increased inequality, unemployment rates, poverty levels and a subsequent deepening of the colonial arrangement of society. In order to address these challenges, there is a need for institutions to adopt management

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strategies that can create those sustainable learning environments in which all can succeed, regardless of their differences, thereby allowing for the transformation of society towards the desired decolonial state. This paper reports on how such management strategies are implemented in two urban, and two rural higher education contexts, respectively. In both categories of institutions; the physical, the physiological, the psychological and cultural modes of being human are used as bases for inclusive and decolonial management strategies which ensure success of all in the 4IR. These seem to give even more workers and students epistemic access to knowledge forms demanded in the 4IR era, irrespective of the geographical or socio-economic location of the institution, thereby ensuring cognitive justice for an even greater number of individuals. These strategies both advance and are anchored in complex problem solving, critical thinking, creativity, people management, coordination with others, emotional intelligence, judgement and decision making, service orientation, negotiation and cognitive flexibility – all of which constitute the context for a decolonial condition.

Keywords*:* Decoloniality, the Fourth Industrial Revolution, Sustainable Learning Environments, Management Strategies, Epistemic Access and Cognitive Justice.

Introduction

This paper explores decolonial management strategies suitable for the creation of Sustainable Learning Environments at Higher Education institutions in the context of the Fourth Industrial Revolution. Management strategies generally give managers ideas and tools for strategic planning, implementation and control that are suitable for the specific organizational conditions, such as those required in higher education institutions (Marsh 2012). Strategies are not fixed and they change accordingly in response to the challenges and the objectives of the institution (Head & Alford 2015:721). The conventional dominant strategies used in many institutions include rewards, job design and descriptt-ion, setting of and management by objectives (MBO), decision-making, delegation, implementation, monitoring and evaluation of such, as well as reporting (Shamim, Cang, Yu & Li 2017). However, due to the potential disruption likely to be caused to these 'neat' conventional management strategies as a result of

the Fourth Industrial Revolution (4IR), improvements aligned with the technological advances are required (Schwab 2015). This looming evolution is forcing different institutions to re-examine how they operate in order to function optimally in the context of the 4IR.

In higher education institutions, managers who are interested in the creation of the decolonial condition need to understand the changing 4IR environment in order to implement relevant and compatible strategies (Morreira 2017). According to World Economic Forum report (Mitch 2018) the ten most needed skills that should be developed by the institutions of higher learning in particular in 2020 are: complex problem solving, critical thinking, creativity, people management, coordination with others, emotional intelligence, judgement and decision making, service orientation, negotiation and cognitive flexibility. Even though these skills may also have been previously targeted by the conventional management strategies, they now have to be upgraded, in order to assist managers in the decolonial process so that qualitative excellence can be achieved in this complex context.

The Fourth Industrial Revolution or Industrie 4.0 (4IR) represents the infinite ability of humankind to store massive amounts of information and data, as well as process them accurately at mind-boggling speeds (Ross 2017). Industrie 4.0 is the era of Artificial Intelligence in which these data are transported over huge distances within seconds amongst an infinite number of users. This period has prompted talk about the Industrial Internet of Things (IIoT) to capture these developments and achievements. According to Schwab (2017), Industrie 4.0 is described as the Industrial Internet of Things (IIoT) where billions of people are simultaneously connected, for example through social media, while performing an unlimited number of diverse activities (Schuster, Groß, Vossen, Richert & Jeschke 2016). Through this IIoT, an infinite number of messages, services and products are moved across vast distances, connecting people ubiquitously and infinitely (Weinman & Euchner 2015). It is the era of robotics, of automation, and of drone technology, when even cars can drive themselves (Surden & Williams 2016).

This 4IR, however, comes with both threats and opportunities. The main threat to many managers in higher education is to ensure that workers and students possess requisite knowledges, skills and competences to enable them to transition with ease to the highest levels of technological strata in their jobs (Jankowski and Marshall 2017). This is what we understand to be a decolonial condition in this paper. When organisations and institutions do not manage this

transition effectively this might result in greater rates of unemployment, job losses, subsequent poverty and social inequality increases (Mitch 2018). On the other hand, the main opportunity created by this revolution is the potential to raise global income levels and improve the standard of living for the majority of people across the globe (Schwab 2017). Higher education institutions are faced with the responsibility of providing quality education in order to ensure that their graduates are able to constitute a pool of talent in the era of Industry 4.0 (Jankowski & Marshall 2017). For this to happen, the managers of such institutions must create and implement the strategies that ensure the creation of Decolonial Sustainable Learning Environments.

Decolonial Sustainable Learning Environments are those learning contexts, opportunities and spaces in which quality teaching, learning, curriculum and governance of the education enterprise are enabled (Le Blanc 2015). This concept is derived from the United Nations' 17 Sustainable Development Goals (SDGs) dating from 2015 to 2030. The 17 SDGs, and various learning theories, jointly validate that the value of one's environment ensures quality education (Hajer, Nilson, Raworth, Bakker, Berkhout, de Boer & Kok 2015). The argument is that one's environment or context is as important in determining the level of one's learning, as one's genetic make-up (Weiner 2012; Kagan 2018). Therefore, once these contexts are established, they provide the opportunity for those who are learning within them, to function with ease in the destined environment. In the Fourth Industrial Revolution, creating such environments would, however, require management strategies to be in place so that challenges such as greater inequality, hence colonisation, can be circumvented. Increasing the separation between low-skill/low-pay on the one hand and the high-skill/high-pay section of the work force as described above, is definitely going to heighten social tensions and colonial social arrangements (Killian & Agathangelou 2016). Therefore, it is imperative that different stakeholders, including in the higher education institutions, collaborate to embrace 4IR and respond to this challenge accordingly. Higher education institutions are leaders in knowledge creation, and they are the major role players in ensuring that quality decolonial education is realised (Khoo 2015). Its managers are thus required to design and implement strategies that will ensure that the education system provides the curricula and governance contexts that meet current and future needs of the people (Govender & Reddy 2019).

From the above premise, it seems obvious that the 4IR cannot be

avoided but that various institutions have to prepare thoroughly in order to balance the cost and benefits thereof (Mitch 2018). These institutions are required to understand the changing environment accordingly so that they are able to provide compatible strategies to survive in this new era. Managers at these institutions need to design strategies that will ensure that their institutions are willing and ready to provide the quality education systems equipped to tackle the transition ahead (Khoo 2015). These institutions as leaders need to provide curriculum that meets the current and future needs of all. Based on the above this paper therefore aims at exploring management strategies suitable for the creation of Decolonial Sustainable Learning Environments at Higher Education institutions in the context of the 4IR. The objectives of this study are therefore to understand how in both categories of institutions, the physical, physiological, psychological and cultural modes of being human are used as bases for inclusive management strategies that ensure success of all in the 4IR.

Background

Higher education as the leader in knowledge creation and dissemination cannot ignore responding to the challenges referred to above. The sector has to create highly advanced 4IR knowledge forms to ensure that 'the technologically enabled' exploit their potential optimally. However, managing the creation and dissemination of such knowledge forms comes with its unique set of challenges. This applies mainly in the rural higher education context, for example, where 4IR knowledge forms might be rare to find and complex to design, given the deep digital divide between the rural and the urban environments, especially in South Africa. For an institution to be able to embrace and benefit optimally from the 4IR, its management has to create conditions for full implementation and utilisation of the digital technologies that currently are still not as widely found or occurring in many rural Higher Education institutions. For example, many universities in rural contexts still manually manage among others their data on enrolments, funding, research output, evaluation of modules and staff, peer system in recruitment, promotions, intellectual property protection, incentives and facilities for staff and infrastructure (Penprase 2018).

On the other hand, for the mainly urban universities that have access to facilities and resources to advance the 4IR knowledge forms, the challenges

might include managing large data sets in a safe and secure manner. Within these large concentrated data sets reside the most vital and confidential individual and institutional information. Thus, should the system be vulnerable to hackers and attackers, the security of the workers and students could be endangered and they could be negatively affected (Tien 2013). Access and information security becomes a challenge when the accuracy, credibility, reliability and consistency of data within and across the institution is jeopardised due to tampering by hackers. This could also affect the morale of staff who may lack the expertise to manage such unreliable large data (Floridi 2014).

The other challenge might be the limited access to digital devices (Floridi 2014), mainly at rural universities. The very basic resources like computers, smartphones and laptops are still not adequately available in some of the rural higher education institution. This poses a serious barrier for the university community who claim to be ready for the 4IR (Mahenge & Sanga 2016). The supply of electricity is at times not reliable. This indicates that, in some instances, these institutions may not yet have surpassed the second and the 3IRs. Consequently, this impacts negatively on transformation towards the decolonial condition and the quality of education, because it limits access to knowledge on the side of both the students and workers (Warner 2016; Lake & Pushchak 2007). Furthermore, how do they prepare for classes in terms of research? How do they access other information that can be used to supplement their prescribed material or guides? The same goes for the managers who are supposed to manage from any location. The question is: if they do not have up-to-date digital devices and accompanying software, how can 4IR be implemented effectively? The fact is that they are then forced to rely on manual processes rather than having the advantage of doing things ubiquitously.

All these challenges lead to the deepening of inequalities hence colonisation and lack of access to requisite knowledge for the university community as a whole. This in turn violates the Constitution's Clause number 16 (1) (b) of 1996 that states that, it is every citizen's right to have access to information (Mbebe 2017). Furthermore, the lack of knowledge by academics (and/or workers) is directly linked to the students' poor success rate in the public Higher Education system in particular (Warner 2016). This is also linked to the workers' job dissatisfaction and levels of attrition. It should be understood that when such conditions prevail, it is important that managers should work hard to ensure that the higher education community in their institution is also able to enjoy the benefits of the 4IR.

Regardless of the many concerns about the security of large data sets in many urban- based Higher Education institutions, these are still valuable to assist in the strategic planning as well as in tailoring services accordingly (Marcus 2015). World Economic Forum (Schwab 2017) and many government departments have made many calls for managers to increase control over how data are managed. This was supposed to have spared many institutions the unpleasant incidents of hacking and more. However, more needs to be done so that the context of each institution is taken into cognisance in order to determine the kind of intervention needed to prepare managers. Once managers are prepared, they will be more ready to embrace uncertainty, ambiguity and risk presented in the 4IR. As digital communications become ubiquitous, data will rule in a world where nearly everyone and everything is connected in real time (Schwab 2017).

The other issue of concern is the lack of access to digital devices. China has been the leader in technologies where many of their institutions are empowered with the Artificial Intelligence-powered chat-box that can communicate with students and workers and can provide some responses to their queries and questions (Wenger 2014; Warner 2016). The above demonstrated how smart devices reduce dependency on the conventional setup of human-to-human contact and in return save time and other costs to the institutions. South Africa has tried to introduce blended learning at all levels of the educational system through the e-learning policy where teaching and learning would occur ubiquitously (Camilleri & Camilleri 2017). Teachers and lecturers were supposed to post interactive materials on Blackboard and/or Moodle to be accessed and used by students to do assignments, learn and to do assessment tasks and so on. e-Human Resource Management (e-HRM) system on the other hand was also well planned but the implementation of blended learning and e-HR Management have been a challenge to many rural Higher Education institutions that lack the right tools (Parry 2011).

Some donor organisations have provided digital devices and training to many rural Higher Education institutions (Li, Zhu & Yang 2012). The main concern in some instances has been resistance by some staff and students to accept the use of new and advanced technologies in the place of the manual way of doing things (Bovill, Cook-Sather, Felten, Millard & Moore-Cherry 2016). However, in spite of all the claims and the blame game, one thing remains constant, and that is that; there is limited access to cutting edge knowledge despite all the interventions made as a result of problems with

appropriate devices and software. There is an urgent need to support Higher Education institutions, especially those in the rural settings in order for them to prepare for the looming 4IR. In order for this preparation to take place there are certain conditions that need to be established. For example, supportive physical, physiological, psychological and socio-cultural environments have to be created, among others (Dallaire, Giguère, Émond & Chaib-Draa 2014; Gabarro 2014). Government departments and the higher education institutions need to be knowledgeable about 4IR so that they are able to take advantage of the benefits, mitigate the challenges thereof, and defend progress they make, effectively. The above challenge management to design and implement, clear and appropriate strategies.

Conceptual Framework and Literature Review

As mentioned earlier, the conventional management strategies, especially in the Fourth Industrial Revolution tend to focus on planning, implementing, control, monitoring and feedback for guidance and achievement of high-level goals and targets (Marsh 2012). Such management strategies seem not to promote economic development of all, or advancement of environmental sustainability and social inclusivity as the centrepiece of its activities (Shultz 2018). in keeping with the demands of a decolonial condition. The focus seems always to be on gaining competitive advantage in the cut-throat rat race of technological designs and implementation (Bovill *et al.* 2016). The main goal is to be better than the rest, to design and create better plans, and advanced gadgets and practices in order to generate as much income as possible (Lee, Wong, Intarakumnerd & Limapornvanich 2019). We see this trend being firmly entrenched even at universities that are now managed as businesses in order to increase income, based on the same economic principles and models - geared towards maximising profits at all costs (Lee *et al.* 2019).

This article explores the strategy for effective management that deviates from the above and advances the principles for equitable and inclusive economic development in an environmentally sustainable manner, especially in this era of the decolonial and the 4IR. Such a strategy focuses on total personhood as the starting point. It recognises that a person's physical aspects are very important and have to be taken into consideration when creating sustainable learning environments in the 4IR (Van den Berg 1971; Robbins 2018). The proposed management strategies go to the crux of what it means to

be human. Van den Berg's theory argues that as humans we are made up of our corporeal bodies with which we present ourselves to the world and others (Smith 2016). The physical aspects enable us to occupy space and perform activities in the realm of time and space. Nobody can be described as human if this aspect is missing. This physical corporeality is the site of identity and its construction (Mahlomaholo 2015). Our learning and management thereof play themselves out on our bodies. Therefore, when management strategies are designed and implemented, the differences in one's physical aspects and corporeality to others become the starting point such that one's physical limitations and strong points become the framework for an effective strategy. Such management strategies customise all efforts to enable one to perform and succeed like everybody else in the complex era of the decolonial 4IR (Kwak, Kim, Kim, Shin & Cho 2013).

The same care is also expended on the physiological dimension. Other than presenting ourselves as this body, this physical being and corporeality only, Van den Berg argues that we also present ourselves as these *growing beings* (Kwak *et al.* 2013). We start off as tiny embryos but in the majority of instances we grow into being strong and capable adults. Our potentiality to grow is what defines our identities. This potentiality is fluid and amenable to change, and dynamism. Thus, effective management takes this aspect seriously and puts it into sharp focus (Smith 2016) Effective management strategies capitalize on this aspect. It valorises it so as to ensure that it is managed effectively for optimum positive outcomes (Smith 2016). Therefore, management takes into consideration the growth and developmental opportunities of all in equal measure. The management strategies enable students and staff to define their goals and targets and use services and digital devices of the decolonial 4IR to achieve such.

At the next plane, our identity is influenced by how we experience this movement of growth, that is: the e-motion (Christou 2011). How we make sense of who we are in the world is one of the most important aspects that craft our psychological make-up (Marks 2014). Effective management should enable students, workers and all to feel comfortable, wanted, and valued in order for them to scale the highest levels of achievement with success. Our psychological make-up constitutes one of the most complex modes of being for any human (Mahlomaholo 2015). It determines how we feel about the world and ourselves. It is the dimension that grounds us, that constitutes who we are and how we ultimately express our identity as fluid and not just fixed

and complete. It is this aspect that enables humans to carry their being from one level to the next in one's head (self-concept/self-esteem) (Marks 2014). Effective management takes this aspect as the basis for engagement and transformation. Therefore, the proposed management strategies are the ones that enables the institutional community to be psychologically comfortable, to find full meaning in participating in the 4IR fully. This is about management that inspires confidence, that enable its community to advance in the design and use of large data sets and digital devices that are accurate, reliable and accelerated. Co-workers and others in the institution are not seen as competitors, but as facilitators and collaborators to enhance the achievements of the institutional community beyond what is individually possible.

The highest aspect of being human is the socio-cultural one. This is the ability to be with others, to define oneself in relation to others in the world. This typically human aspect enables us to interact for the valorisation of self and others (Van den Berg 1971; Robbins 2018). It is an aspect that enables humans to know good from evil (juridical), to know what is right from wrong (juridical), to know how to be disciplined and be ethical and appreciate beauty in all its forms (aesthetics), to believe (pistical), to act economically, and to care (Harter 2015). It is about being conscious about how inequality, poverty and unemployment constitute evils that have to be addressed and attacked. The socio-cultural dimension represents the highest level of being human (Glăveanu 2010; Seamon 2016). It is about having a past, a present and a future (historico-cultural). It is about the ability to self-reflect and to be able to stand outside of oneself and be critical about oneself and one's actions. Therefore, the socio-cultural constitutes the ultimate ontological basis.

Effective management strategies use the above as the basis for creating conditions for the success of all. Furthermore, effective management involves implementing cognitive justice approaches that take every student and staff member's station in life as a valid starting point and then provides appropriate scaffolding mechanisms to bring out the best in all of them (Andreotti, Ahenakew & Cooper 2011). It is about valuing and valorising all and believing that, with appropriate support, they all can achieve beyond anybody's wildest expectations. This is about designing a management strategy capable of achieving the above for all (Brydon 2012). Cognitive justice is also being understood as a call for making other ways of knowing visible. It also includes knowledge of the marginalized and those defeated by history to regain importance and worth. It implies the diversity of the knowledge and the

equality of knowers. It is about opening up the epistemic access to all regardless of their backgrounds (Anderson 2012). This implies, believing that in the 4IR, every citizen is a scientist and each person is a potential expert who can participate fully and meaningfully therein.

Therefore, this management strategy takes into consideration all cultural constructions and persuasions as both the starting point and the goal. Participation in the 4IR is managed so as to enhance and intensify self-awareness. It actually broadens and extends identify construction and its formations to more advanced modes in the context of the IIoT (Tondi 2019). These new management strategies in the 4IR are about broadening these identities such that nobody is excluded. Cultural dimension includes focus on the socio-economic wellbeing of all. It is about faith; aesthetics and the ethics of being that inform customisation of our learning and performance to the highest standards of 4IR (Mdluli & Makhupe 2017).

All the above confirm a management strategy, which is unique, personal, inclusive and respectful of all institutional communities to become and to achieve. It is a management strategy empathetic to differentials presented by all, irrespective of their station in life. Each student and staff's level of cognitive functioning in the context of their unique physical, physiological, psychological and socio-cultural conditions becomes the basis for mediating successful participation in the decolonial 4IR. No effort is spared to enable all to move towards the highest levels demanded with regard to knowledge and skills bases in this complex era.

Methodology and Design

The data presented and analysed in this paper arise from the everyday interactions with practitioners and practices at the four universities mentioned earlier. For purposes of this paper we ensured anonymity of the institutions and that of the people with whom we interacted. These individuals shared the intentions of their actions in their usual everyday activities. They also shared their reflections generously in focus group discussions per institution. On our part we attempted at all times to observe and abide by the highest research ethical standards. We obtained permission to use the information they shared with us with the promise that their identities would not be revealed and that their integrity would be protected at all times.

More data also come from documents which are in the public domain

to which we applied Critical Discourse Analysis - CDA (Van Dijk 2015) techniques in order to make sense of how effective management strategies were used to create decolonial sustainable learning environments in the 4IR. The four universities chosen were those to which we had easy access, and which were implementing seemingly successful management strategies in the context of the decolonial 4IR. The data gleaned are not for comparison between the institutions but to show how similarly they approached the creation of sustainable learning environments in the decolonial 4IR era, in spite of their location in the different socio-economic contexts. The Critical Discourse Analysis (CDA) techniques we used, capitalised on the text, both written and spoken, as the basis for making findings in relation to the research question of this paper Then the analysis progressed to the level of the discursive practices to explore how habits of the mind informed the text and shaped the meaning of what was being said. What we say as humans is in most instances informed by what we are used to saying, doing and listening to and thus one can trace where we come from on the bases of all these. Finally, we looked at the social structural arrangements and how these informed the discourses being analysed. These were done seamlessly so as to privilege the outcome of the analysis rather than the process.

The conclusions drawn and recommendations made are finally contextualised in terms of the literature to indicate how different and/or similar they are to previous research, policies and theories. This paper does not attempt to formulate general laws or predict or establish any causal relations between and among factors under scrutiny herein. The idea is to understand the situations as they present themselves without attempting any generalisation beyond the given contexts. In order to operationalise all the above, we used two scenarios to anchor the data, their analysis, findings, conclusions and recommendations.

Presenting some Illustrative Scenarios

The scenarios below are from some higher education institutions that implement seemingly successful decolonial 4IR management strategies. The urban universities (URB1 and URB2) are better resourced. They have many and well-functioning computer laboratories for students and staff. Students and staff over and above the university facilities, have their own gadgets like laptops and smart phones. During the periods of strikes when the physical

campus is inaccessible, lecturers and their students are able to continue with their normal academic work on Blackboard and Moodle software. The point we are making is that these two urban universities have advanced significantly in terms of embracing the advent of the 4IR, comparatively speaking. Their major concern currently is securing their data, hence the first scenario below.
The other two rural universities (RUR1 and RUR2), due to historical factors are still under-resourced, although serious efforts are underway to acquire the requisite technologies. Currently the tele- and videoconferencing facilities are already available, though more has to be done to strengthen them and their use. Use of Information, and Communication Technologies - ICT is still not as wide-spread although there are efforts to broaden participation of all lecturers and students in the use of Blackboard, Moodle and other software through the university's declared e-strategies.

Table 1: Funding[1]

Table 1 shows the audited and publicly available data on the calculations of the Teaching Inputs allocation per selected Institution from 2012 to 2016. The 2017 and 2018 data were still under audit. These calculations are based on a number of variables including the number of students enrolled per; institution, qualification, year level, Classification of Education Subject Matter (CESM – category of modules where examples are those preparing students in scarce skills versus those that are not so scarce), student learning, that is; whether they are full time or part time, repeating or not, the number and qualifications of staff, staff-student ratios, etc.

A survey over this five-year period shows that urban universities (URB1 and URB2) have higher Teaching Inputs allocations compared to their rural counterparts (RUR1 and RUR2). The implications are that the levels of government funding are thus consistently skewed away from the rural, thus favouring the urban universities. More money is thus available to the urban universities to improve their infrastructure, automate their systems and strategies for recruitment and evaluation, among others.

[1] Data populating the above Table 1 have been gleaned from the successive reports of the Department of Higher Education and Training – DHET (2012; 2016a). Ministerial Statement on University Funding 2011/2012 and 2013/2014 as well as 2017/18 and 2018/19. Pretoria: DHET

The differences in terms of allocations of resources (human capital, infrastructure, etc.) that are so crucial for welcoming and embracing the looming 4IR between the two categories of universities, namely rural and urban, could be ascribed to this differentiated funding from the Department of Higher Education and Training – DHET.

	URB1	**URB2**	**RUR1**	**RUR 2**
2012	**98 606**	**55 784**	**21 264**	**42 992**
2013	99 965	59 556	22 804	42 992
2014	108 005	56 779	24 610	38 299
2015	110 582	57 764	23 610	38 770
2016	112 487	58 882	24 445	39 266

Table 1 above does not capture all the categories of funding made available to the public higher education institutions – namely: Teaching Inputs, Teaching Units Outputs, Infrastructure and Efficiencies, Research Development, Research Outputs, Teaching Development and University Capacity Development Grants. Yet, it reflects the major and significant category of funding that describes and explains the differences as indicated above.

The rural universities are faced with huge backlogs in terms of provision of basic facilities that urban universities do not experience. Over and above attending to infrastructure backlogs with the meagre financial resources made available, RUR2 as rural university example, has to make provision for the cost of huge distances that staff have to travel on daily bases to ensure efficiencies at all its campuses that are spread over a huge square kilometre radius. These arrangements call for efficient and cost-effective management strategies that 4IR promises to deliver through advanced ICT technologies. The call is for these rural universities to provide more services with fewer financial resources which, to date, has placed huge demands on how they are managed.

Table 2: Enrolments[2]

Table 2 below shows the distribution of audited student enrolment figures

[2] Data for Table 2 above are obtained from the successive reports of the Department of Higher Education and Training – DHET (2014b; 2015; 2016c; 2017b; 2018b). Statistics on Post-School Education and Training in South Africa. Pretoria: DHET.

across the four universities under scrutiny.

	URB1	**URB2**	**RUR1**	**RUR2**
2012	57 508	32 375	16 434	24 613
2013	57 553	31 877	16 591	24 122
2014	56 376	31 032	16 663	23 946
2015	55 984	30418	16 891	25 993
2016	53 232	30269	17 662	28 581

As is the case with funding, for over a period of five year, the two urban universities continue to consistently show higher levels of student enrolments compared to those in the rural settings. The better-resourced urban universities continue to provide better and more attractive facilities, hence education. Their programme and qualification mixes are relevant and up to date, thus offering curriculum choices that better increase the chances of graduate employability (Charles 2016). Urban universities, especially due to their location and better resources provisioning attract better-qualified staff with impressive curriculum vitae, research profiles and up to date teaching methodologies (Zavala 2013). The higher levels of student enrolment mean better funding to afford all the above and the cycle of inequality between the urban and the rural is repeated and reinforced as the latter struggle to attract staff and students (Charles 2016). The prospects of adopting 4IR at these rural institutions become even more distant as a result, although because of their location, the need for these technologies is all the greater.

Although RUR2 looks as if it is getting closer to the URB2 in terms of enrolments figures in 2016, this is mainly as a result of students who take long to complete their studies at the former, and thus continue to fill the residences and the lecture halls without generating more income for the university, while new students have to be admitted into the university at the same time (RUR2 2018). Such students become more of a burden for the institution and create challenges for the effective management thereof. The main challenge is also with regard to stretching the limits of available resources beyond the numbers they can accommodate (RUR1 2018). The pass rates at these rural universities may be looking like they are catching up with those of urban universities, but the fact of the matter is that their throughput rates are still very low and not comparable (Maphosa, Sikhwari, Ndebele & Masehela 2014).

Table 3: Research Outputs[3]

Table 3 offers additional evidence of the glaring disparities noted between the profiles of the rural and the urban universities. Rural universities struggle to even meet the 1.5 unit of research output mark. This means that the share of their research outputs individually constitutes less than a percentage point of the total South African universities' research outputs.

	URB1	**URB2**	**RUR1**	**RUR2**
2012	11.7%	5.2%	0.6%	0.5%
2013	11.5%	4.8%	0.6%	0.3%
2014	11.0 % 1176Staff 1677.59 Units	5.0% 986Staff 759.88 Units	0.7% 285 Staff 110.74 Units	0.2% 591Staff 26.07 Units
2015	11.3% 1192Staff 1837 Units	4.4% 845Staff 711.24 Units	0.8% 295 Staff 130.40 Units	0.3% 582 Staff 49.41 Units
2016	11.51 1271Staff 2040.88Units	5.09% 841 Staff 927.29 Units	0.67% 306 Staff 122.89 Units	0.28% 571 Staff 50.41 Units

According to Table 3 above, consistently over the five-year period under study, urban universities far outshone their rural peers. For example, the URB1 has continued to produce slightly above 11% of the national research output. The URB2's research output on the other hand has been hovering around 5% share of the national scene. Again, these differences can be ascribed to inequality in terms of funding, hence fewer numbers of research academics at rural universities. This cycle of inequality gets repeated and reproduced over and over again as more funding attracts publishing academics and as such less

[3] Data for Table 3 is obtained from successive reports of the Department of Higher Education and Training – DHET (2014a; 2016b; 2017a; 2018a). Report on the Evaluation of the 2016 Universities Research Outputs. Pretoria: DHET.

research money is generated at the rural universities, compared to urban ones. This calls for stronger management strategies that can interrupt these cycles of inequality, so as to enable the rural universities to realise both their potential and research strengths.

The First Scenario comes from Urban Universities of URB1 and URB 2

As indicated earlier urban universities are more prone to cyber-attacks due to their sizes, location and the kinds of data they hold (Townsend 2013). The large data sets at higher education institutions for example, consist of financial, staffing and student information. The possibility that a university can be infiltrated through phishing, spamming and hacking constitutes a risk that can undermine the credibility of its work, its qualifications and all. This can dent its position of being a trusted partner in the sector, the country and the world at large.

Thus far, both urban universities seemed to respond successfully to various digital attacks. These universities seem to have improved their cyber safety and security practices in order for them to survive these complex developments of the Fourth Industrial Revolution. For example, URB1 summarised its inclusive strategy as follows:

> We are in the process of implementing a totally new Firewall platform for the university. It took Information, Communication and Technology unit in excess of 12 months to investigate and research the most applicable digital solution and we piloted several options. The Rectorate approved the business plan and the kit was ordered from the two leading countries in the North. When deployed, and the initial target date is soon to be announced, the University will be benefiting by being: i) be Proxy free, (ii) will be able to fully deploy dual-factor authentication, (iii) will be able to segregate and 'manage' older decentralised laptops and desktops in a manner that they are no longer a real threat to the digital security of the University, (iv) manage bandwidth (Free Internet to students versus going-concern business of the University), (v) enable and support the BYOx (Bring Your Own Anything, gadget), (vi) significantly increase digital security, (vii) better management of digital vulnerabilities, etc. (URB2 2018: 29).

The above strategy towards securing the data sets seems to be including the larger community of the university by providing them with the available information behind the cyber-attacks. In this paper we single out the cyber-attacks as an example of 4IR where automation to break and interrupt established official ICT systems is used. This is an instance where advance technologies are used to truncate the functioning of the normal software to confuse it and make its processes dysfunctional. This is the worst situation for any user of data in the 4IR. Programmes were put in place for all staff to be trained to identify and protect the university against cyber-attacks. Many attacks seemed to come through the student and staff emails. They were now being asked to update and validate their accounts. The ICT section was making it its business to ensure that the entire university community understands the nature of the war that is taking place in the cyber world. The university community was made to realise and understand their responsibilities towards securing their data. They were further made to understand the power of the recent 4IR that some were taking for granted. For example, they were made aware that the whole data sets from their research, teaching and learning as well as management which they have built so meticulously over the years could be wiped out by a virus at a click of a button if they were not careful and proactive.

The above benefits alluded to by the university seemed to be inclusive in the sense that they were opening epistemic access for students and staff regardless of the challenges of the Fourth Industrial Revolution. They were being empowered to know about and operate advanced technologies and their system was continuing to be upgraded for the benefit of everyone.

The Second Scenario Emanates from the Rural Universities of RUR 1 and RUR2

These universities were also responding positively to the challenges linked to the limited access to the digital devices they possessed. For example, RUR2 is a multi-campus institution that requires its managers to spend most of their time in extensive travelling when they manage their campuses. This exercise consumes most of their management time and leaves them without much time to pursue other university activities (RUR2 2018).

In response to this challenge, RUR2 decided to collaborate with other universities in the country to invest in the use of tele- and video-conferencing

technologies (RUR2 2018). Through such technologies, a skilled academic is still able to conduct lectures efficiently over long distances, thereby reaching students from many sites, since they have access to the conducted lecture. This advanced technology also allows managers to do their work effectively wherever they are. This is a significant benefit of the 4IR that makes digital communications ubiquitous. On the other hand, with the use of Videoconferencing, teaching and learning are made to be interactive across long distances, including diverse cohorts of students at their respective sites (Müller-Schloer & Mähönen 2000:299; Jones, Richards, Cho & Lee 2019:61). Thus, the issue of multiple campuses and the challenges of assuring quality teaching across them are being addressed, although more has to be done. The benefit through interactive teaching and learning also empowers lecturers to conduct their teaching at multiple campuses more easily. This seems to impact and has a positive relationship with job retention of staff. These 4IR technologies enable humans to perform tasks and activities effectively from wherever they are.

The above scenarios regarding two categories of universities with two different backgrounds, illustrate the possibilities that can be created by managers who think of the human being as a total being, who besides his/her physical dimension has other needs that have to be catered for towards the creation of decolonial sustainable learning environments. The main reason for such management strategy being effective in creating Decolonial Sustainable Learning environments in the Fourth Industrial Revolution seems to be its ability to empower its institutional community and provide quality education that is inclusive of all. This ensures that cognitive justice is achieved.

How Staff Experience Decolonial 4IR Management Strategies

As part of the aim of this paper to explore and understand how decolonial management strategies at rural versus urban universities were used to create sustainable learning environments in the context of the 4IR, we conducted one-hour focus group discussions at each of the abovementioned universities. Data were collected over a period of three years, as and when it was possible to talk to the participants. Each focus group discussion session was made up of four people who came from the university's senior management, middle management, academic and service staff respectively.

In presenting the data below we highlight the major trends and patterns

of how the participants say they experience their respective university's management strategy and style in terms of some-key issues for the 4IR, namely; strategies for recruitment and evaluation

Different universities use different strategies for recruitment of students and staff, evaluation and promotion of staff; Intellectual Property protection, incentives and facilities for staff Some strategies are more conventional, and paper based while others are 4IR compliant and are interactive, using pop-up messages to attract attention. Such strategies provide captivating and automated information about the institution. This pulls the potential student and staff into the relevant website where he/she can ask questions which are being answered so that growing curiosity is promoted. The more 4IR compatible institutions tend to adopt more democratic approaches to sharing of information on these platforms in the manner described above because they have technologies to protect the integrity of their information.

Even in the evaluation and promotion of staff, Intellectual Property protection, incentives and facilities for staff advanced technologies do play a role. The less 4IR compatible institutions tend to rely mostly on submissions of hard copies of forms and reports while the other institutions would be using electronic versions, that are easy to transport, to use and to evaluate both inside (locally) and outside of the institution (nationally and internationally) for enhanced quality.

Strategies for Recruitment

At all universities irrespective of whether they were rural or urban, there were committees dealing with staff recruitment chaired by either the Vice-Chancellors (VC) or Deputy Vice-Chancellor (DVC) in the rural universities, and by the relevant Dean/Director in the more urban ones. However irrespective of who chaired, all the committees had a mandate from the universities' Council through the VC to implement the approved universities' recruitment policies. A closer look at all the policies show that they all advanced the principles of inclusivity and meritocracy. Each Department or Directorate or unit had to motivate and demonstrate the need to recruit a staff member based on the democratically designed and Council approved staff establishment. No post would be considered for advertisement if there were no provision for such in the university establishment. The criteria for appointment were also clearly spelt out in the policies and departmental strategies. The

motivation had to use the criteria as bases for making a case for the post. A participant in one of the URB1's 's group discussion sessions noted, that;

> *the process is cumbersome, and sometimes takes too long because of all the supporting documents that have to accompany the motivation*.

The other participants from the same institution corrected her. They indicated that, checks and balances were necessary, hence the duration of the process.

> *All those were in order to make the process transparent and inclusive in that all stakeholders had to express themselves on the advert, the process of recruitment, selection, interviews and the vetting of the recommended candidate.*

Without belabouring the point, there seems to have been similarity in the way participants understood the management of the recruitment process. The common theme across all four universities was that all owned the strategies as they participated in the crafting and implementation thereof. At all levels there was an attempt to be inclusive of all stakeholders, as the understanding was that; *the more heads were put together the better they could look at all aspects of recruitment in ensuring that quality was assured.* The only difference between the rural and the urban universities was the extent to which ICT was used by the Human Resources Departments in executing the decisions of the various committees. Many of the processes at the urban universities were automated where, for example, classification and summarising of the applicant's CV was done through relevant software as all information was captured online and could thus be manipulated with greater ease. The sheer volume of the applicants' data that urban universities had to deal with for most positions to be filled made it difficult to process the data manually. However, the software was executing processes that were agreed upon collectively. The Office of the Human Resources Development and committee members were also trained in the use of the software and policies accordingly in order to fast track and streamline the processes.

Evaluation and Promotion of Staff

Our understanding is that all universities had to have democratically crafted

and Council approved policies and procedures because the DHET, which controlled all public higher institutions, demanded that these processes be in place and in line with the constitution of the country. It is because of this that there were lots of similarities irrespective of the location of the university. The policies for evaluation of staff without exception, at all universities in this study, emphasised that academic staff had to show expertise and experience in teaching and learning, research, community service and service to the universities. Each university had developed criteria that were graded from 1 to 4 where 1 represented emergent expertise and skill and 4 represented above average strength in the measured competencies.

> *It is not easy to be subjective when applying these promotion criteria, even when one is the chair of the promotions committee because they are so detailed and cover all aspects of a competency, which is evaluated. Besides, because we all participated in the crafting of such at Faculty Board and Senate meeting, we are all aware of the reasoning behind these criteria and the ways they empower us all and the university to becomes a respected brand.*

Another participant below, at the RUR1 group discussion, referred to above, commented in support of the above views expressed by his colleague:

> *You see the evaluation of staff by students is such an important aspect of these criteria to show evidence of the applicant's effectiveness in teaching and learning. As academics we have to compile a file of evidence everyday, so that we can in the end produce evidence that cannot be contested when we apply for promotion. This aspect is especially crucial because it gives students, who are the recipients, a voice in the evaluation and promotion of their lecturer.*

In the entire group discussions conducted at all the four universities, the participants expressed appreciation of the way in which evaluation and promotion of staff were conducted. They appreciated the objective manner in which that was done and how justification for all the decisions were provided and how each academic knew how to compile his or her portfolio of evidence as they were taught and supported by the respective Teaching and Learning Centre experts.

Again, at the urban universities, the processes were done online, as there was software that assisted in compiling and sorting out the applications in terms of predetermined criteria. Most staff used software like End Note to compile their portfolios and submit them on-line with all documents in electronic format. At the rural universities there were emergent attempts to use electronic media, although most still used hard copies and emails to send documents. In all universities, duly constituted committees were set up to consider the applications in a fair, transparent and developmental manner. Staff were always supported from the point of compiling their portfolios to the point of submission.

Intellectual Property Protection, Incentives and Facilities for Staff

At all the institutions, policies towards the protection of intellectual property are in place. In fact, from as early as the time a staff member joins any of these institutions, he or she is required to read and sign that he or she has read and understood this policy. The central idea of the policy is to make staff aware that all outputs created while in the service of the university belong to the respective university because the staff member used the time and resources made available and paid for by the university.

However, the universities encourage staff to produce research output as well as other artefacts in the execution of their teaching, learning and community engagement that can be commercialised to benefit both the staff and the university. Intellectual property policies make provision for staff to be given incentives that encourage them to do more as well as invest more time in advancing the collective agenda of the university. A participant from the UFS commented that,

> *… If it were not for the research incentive provided by the university, I would not have been able to produce this respectable curriculum vitae I have produced in the last three years. The research incentives provided enabled me to create this big research team you see where 15 academics collaborate in research and supervision of these 48 students towards their MEd and PhDs. The team is able to pay student bursaries, field trips for staff and students as well as conference attendance internationally and locally. Actually, one of our staff has*

> *even managed to get NRF rating from the work of this research project that the university supports through enabling us to host an annual international conference. The university sponsors accommodation and travel costs of speakers as well as the conference*

Along the same lines at RUR2 a participant noted that the university has opened many doors for her in terms of assisting in the patenting of a gadget that will be used by patients in hospitals.

> There were just too many legal hurdles that I could not handle on my own. The university provided support and helped to establish connections on my behalf with the relevant legal people as well as financed the travel and services that the external lawyers provided.

Using Inclusive Management Strategies to Create Decolonial Sustainable Learning Environments in the 4IR: Analysis, Findings and Discussion

The scenarios above focused on four universities in two different locations in South Africa, that attempt to create decolonial sustainable learning environments in the 4IR. While urban universities emphasised cyber security, rural universities were more concerned with acquiring high technology competencies and gadgets. A closer look at the management strategies of the four institutions, demonstrate similarities in terms of creating epistemic access and thereby advancing cognitive justice in their different approaches operationalised in diverse institutional contexts (Bovill, Cook-Sather, Felten, Millard & Moore-Cherry 2016; Camilleri & Camilleri 2017). These anchored in complex problem solving, critical thinking, creativity, people management, co-ordination with others, emotional intelligence, judgement and decision-making, service orientation, negotiation and cognitive flexibility.

The Physical

The management strategies at all the four institutions seem to address the issues of the provision of the physical infrastructure and protection thereof - although at different levels – to facilitate and embrace the 4IR. There are efforts at all to

ensure that students and workers are safe and secure in terms of their physical needs and requirements. Each has to have access to a computer or another gadget that would enable them to firmly participate in the 4IR. The management strategies are that every member of the university community is able to function meaningfully in this context without any hindrance (Glăveanu 2010). At all universities there are policies and strategies to ensure that this objective is achieved. The above demonstrate that there are attempts to open up access to knowledge (Millard & Moore-Cherry 2016; Camilleri & Camilleri 2017) by all through provision of materials that enable students and workers to get into the information highway of the cyberspace. This is a matter of cognitive justice (Millard & Moore-Cherry 2016; Camilleri & Camilleri 2017) where even those who would not otherwise have had access to 4IR knowledge forms, are empowered and provided with the means to do so, and thus participate therein meaningfully. This is done on their terms and the pace with which they are comfortable.

The Physiological

Opportunities for staff and students to develop and take their rightful position in the 4IR era are created through the abovementioned management strategies that are socially inclusive of all (Wenger 2014). As mentioned earlier, there are policies, strategies and actual plans to take each individual through stages of development that would enable them to understand, to operate and operationalise gadgets and services in the 4IR. The issue of epistemic access and cognitive justice can thus not be over emphasised (Seamon 2016; Shultz 2018; Tondi 2019).

The Psychological

categories of At the psychological level, data above show that the two institution; were similar in ensuring that staff and students could find fulfilment in belonging to their respective universities (Charles 2016; Floridi 2014). They gained self-respect when discovering their new abilities to operate gadgets they considered foreign (Bovill, Cook-Sather, Felten, Millard & Moore-Cherry 2016; Camilleri & Camilleri 2017; Charles 2016; Floridi 2014; Gabarro 2014; Glăveanu 2010). Over and above the question of safety and security of data they were also supposed to be happy and fully cognisant of their changing

roles. They were made to see the meaning in participating fully in the 4IR practices embarked upon at their respective institutions. Being at these institutions were meant to provide opportunities for self-realisation and actualisation through full participation (Glăveanu 2010; Gabarro 2014). Gadgets used at these institutions were also meant to enable all to extend their individual identities such that they are everywhere at the same time and can access, experience even at places where they have never been physically and otherwise (Charles 2016; Floridi 2014; Camilleri & Camilleri 2017).

The Socio-Cultural

The management strategies referred to above have enabled students and staff in their individuality to interact and learn from one another socially and collectively as they move firmly towards the 4IR (Glăveanu 2010). All were able to customise the 4IR practices to their particular context and individual approaches. They were able to find roles to play as the 4IR practices unfolded. Management had created many opportunities for that to happen in a deliberate manner. In the collectivised space they learned about ethics and aesthetics as aspects of the 4IR (Glăveanu 2010; Zavala 2013; Shultz 2018.). They discovered that after all there was nothing to fear in so far as the 4IR is concerned. Rather, through inclusive management strategies, they learnt that the new technologies were meant to make their lives easier while they become more human (Van den Berg 1971; Weiner 2012; Bovill, Cook-Sather, Felten, Millard & Moore-Cherry 2016; Camilleri & Camilleri 2017; Tondi 2019).

Conclusion

In this paper, effective management strategies suitable for the creation of decolonial sustainable Learning Environments in the context of the Fourth Industrial Revolution were explored. The paper defined the operational concepts so as to enhance the deeper understanding of the reader. The challenges, components, conditions, barriers, as well as indicators of success in the creation of sustainable learning environments, were identified and analysed accordingly. The paper finds that it is only when epistemic access is opened up to all, irrespective of their differentials that Decolonial Sustainable Learning Environments can be created. Thus, cognitive justice is achieved in the new era, by ensuring that no one gets left behind to suffer increased

inequality as an inherent risk for the Fourth Industrial Revolution rather than enjoying the benefits of this revolution. Therefore, the paper forms the basis for effective management strategies that may be tested further empirically in future research.

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